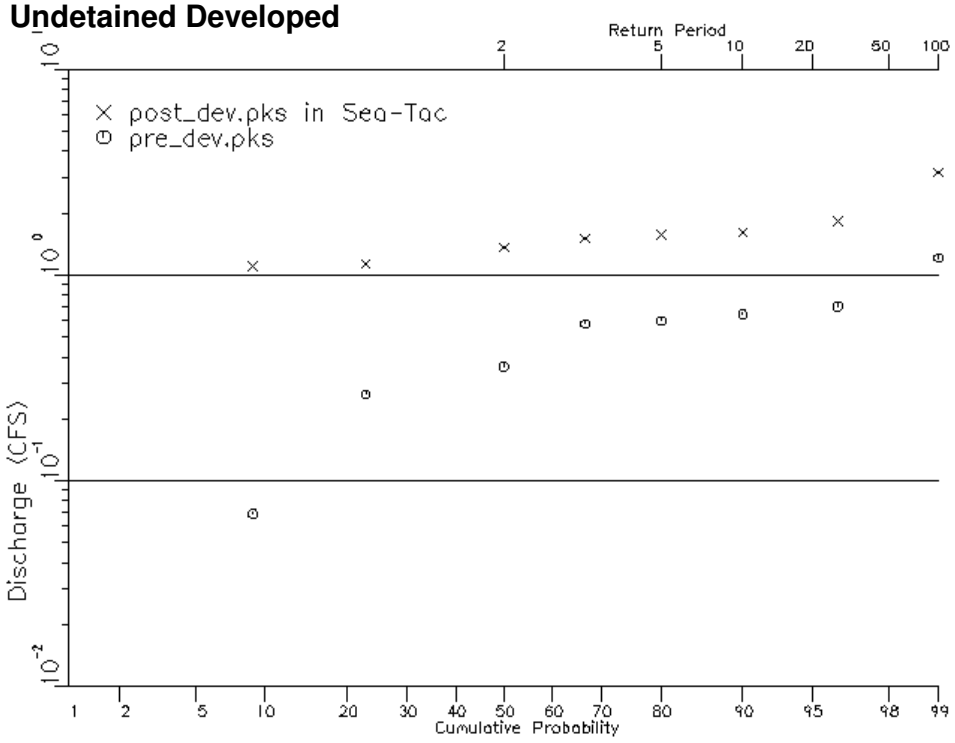
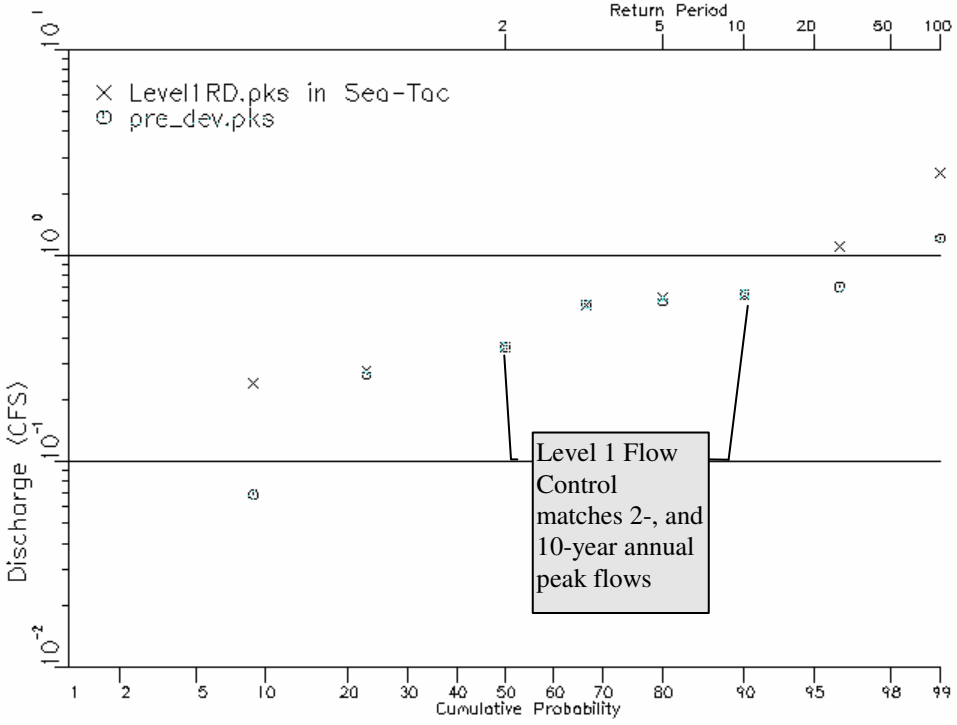
FIGURE 3.2.2.B EXAMPLE FLOW FREQUENCY ANALYSIS

Undetained Developed



Detained Developed



Flow frequency information is derived from the time series flow file by plotting the peak annual events in the runoff file and calculating runoff frequencies using a Log Pearson distribution. The **return periods calculated in KCRTS** are: 100-year, 25-year, 10-year, 5-year, 3-year, 2-year, 1.3-year and 1.1-year. The 50-year return event is an interpolated value using the 25-year and 100-year return events

❑ FLOW DURATION ANALYSIS

Flow durations are important because they show the change in duration of all high flows rather than the change in frequency of the peak annual flows. Channel scour and bank erosion rates rise proportionally with increases in flow durations. Flow duration analysis can only be conducted with continuous flow models or from gage records.

A *flow duration curve* is simply a plot of flow rate against the percentage of time that the flow rate is exceeded. In a continuous flow model, the *percent exceedance* of a given flow is determined by counting the number of time steps during which that flow is equaled or exceeded and dividing that number by the total number of time steps in the simulation period. Flow duration curves are usually plotted with a linear flow scale versus a log scale of percent exceedance. The log scale for exceedance percentage is used because geomorphically significant flows (flows capable of moving sediment) and flows that exceed the 2-year flow typically occur less than one percent of the total time.

Durations for Flow Control Standards

The **Level 2 flow control standard** described in Section 3.1.2 (p. 3-5) requires matching predevelopment and post-development flow duration curves for all flows greater than one-half of the 2-year flow up to the 50-year flow.

KCRTS provides flow duration curves for either flows or water levels. To support facility design, KCRTS will create a *"target" predevelopment duration curve* for the range of flows being analyzed. To simplify design, **brief excursions**[1] above the target predevelopment duration curve are allowed for flows greater than 50 percent of the predevelopment 2-year. These excursions shall not increase the discharge by more than 10% at any duration level and must be strictly below the target curve at the low end of the range of control (i.e., 50% of the 2-year peak flow). This allows efficient design using only two orifices for most applications; see the *KCRTS Computer Software Reference Manual* for a detailed example. An example of a flow duration analysis is shown in Figure 3.2.2.C (p. 3-33).

The **Level 3 flow control standard** matches predevelopment and post-development flow durations over the same range of predevelopment flows as the Level 2 flow control standard. In addition, the 100-year post-development peak flow must be contained within the facility and controlled to predevelopment levels. This standard provides additional storage volume over the Level 2 flow control facility, which substantially mitigates the impacts of increased volumes of surface runoff on downstream, volume-sensitive flooding problems.

The **Level 1 flow control standard** does not require flow duration analysis because it addresses peak flows only.

[1] Brief excursions may not result in more than 50% of the target duration curve being exceeded.